Fire Observations from New Instruments

Louis Giglio (University of Maryland)
and many others

GOFC-Gold Fire IT Meeting

18-19 October 2011, Stresa, Italy

Among the Many Others

- Olivier Arino
- Ivan Csiszar
- Isabel Cruz
- Philip Frost
- Rob Green
- Simon Hook
- Marisa Kalemkarian
- Eckehard Lorenz
- Hugo Marraco
- Bob Murphy
- Jeff Privette
- Bonnie Reed
- Haruhisa Shimoda
- Tim Lynham
- Martin Wooster

Major Future Satellite Systems

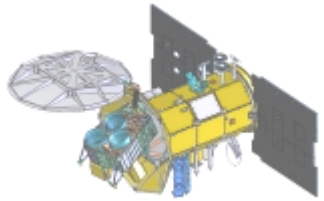
Geostationary		
Satellite / sensor	Resolution	Bands
GOES-R ABI (2015)	500 m - 2 km	VIS, NIR, SWIR, MIR, TIR
Polar		
Satellite / sensor	Resolution	Bands
GMES Sentinel-2 MSI (2013)	15, 20, 60 m	VIS, NIR, SWIR
GMES Sentinel-3 SLST (2013)	500 m - 1 km	VIS, NIR, SWIR, MIR, TIR
NPP/JPSS VIIRS (2011/2016)	375 m, 750 m	VIS, NIR, SWIR, MIR, IR
TET-1 (2011)	42 m, 370 m	SW, NIR, MIR, TIR
GCOM-C SGLI (2014)	250 m, 500 m, 1 km	VIS, NIR, SWIR, TIR
HysplRI (2019)	60 m	VIS - SWIR, MIR, TIR
LDCM (2012)	15, 30, 100 m	VIS, NIR, SWIR, TIR
Geo-Africa (2014?)	25 m	?, MIR, TIR

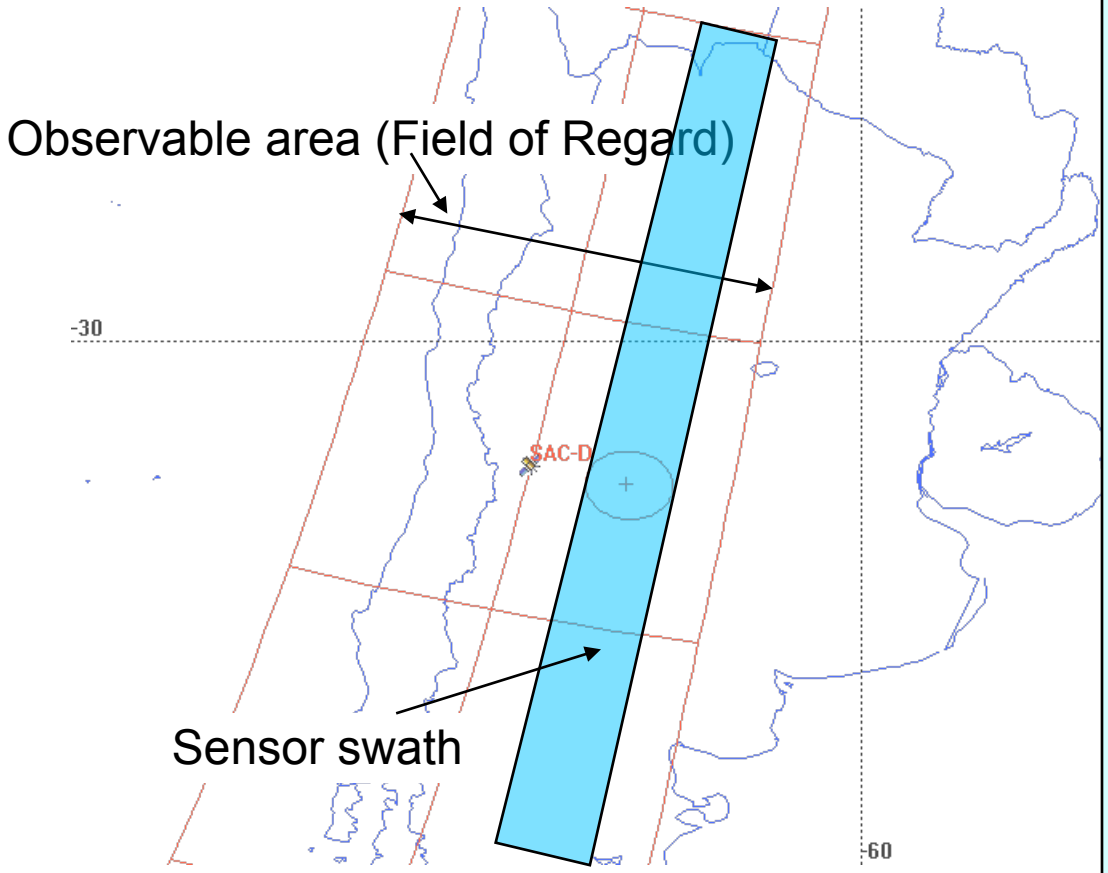
This is a preliminary list.

SAC-D

- SAC-D (Satelite de Aplicaciones Cientificas-D) launched July 2011
- Instrument suite includes Aquarius (ocean salinity), HSC (High Sensitivity Camera) and NIRST (New IR Sensor Technology)

NIRST Land and Sea Surface Temperature Algorithms





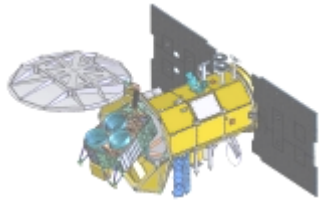
NIRST Bands and Geometry

- 3 Bands:
  - ✓ B1: 3.4 – 4.2 μm
  - ✓ B2: 10.4 – 11.3 μm
  - ✓ B3: 11.4 – 12.3 μm
- Swath: 180 Km at nadir
- Spatial resolution:
  - ✓ 350 m across track
  - ✓ 410 m along track
- Boresight pointing: +/-30° from nadir
- About 1000 km observable area across track

NIRST over Argentina and Canada

H. Marraco

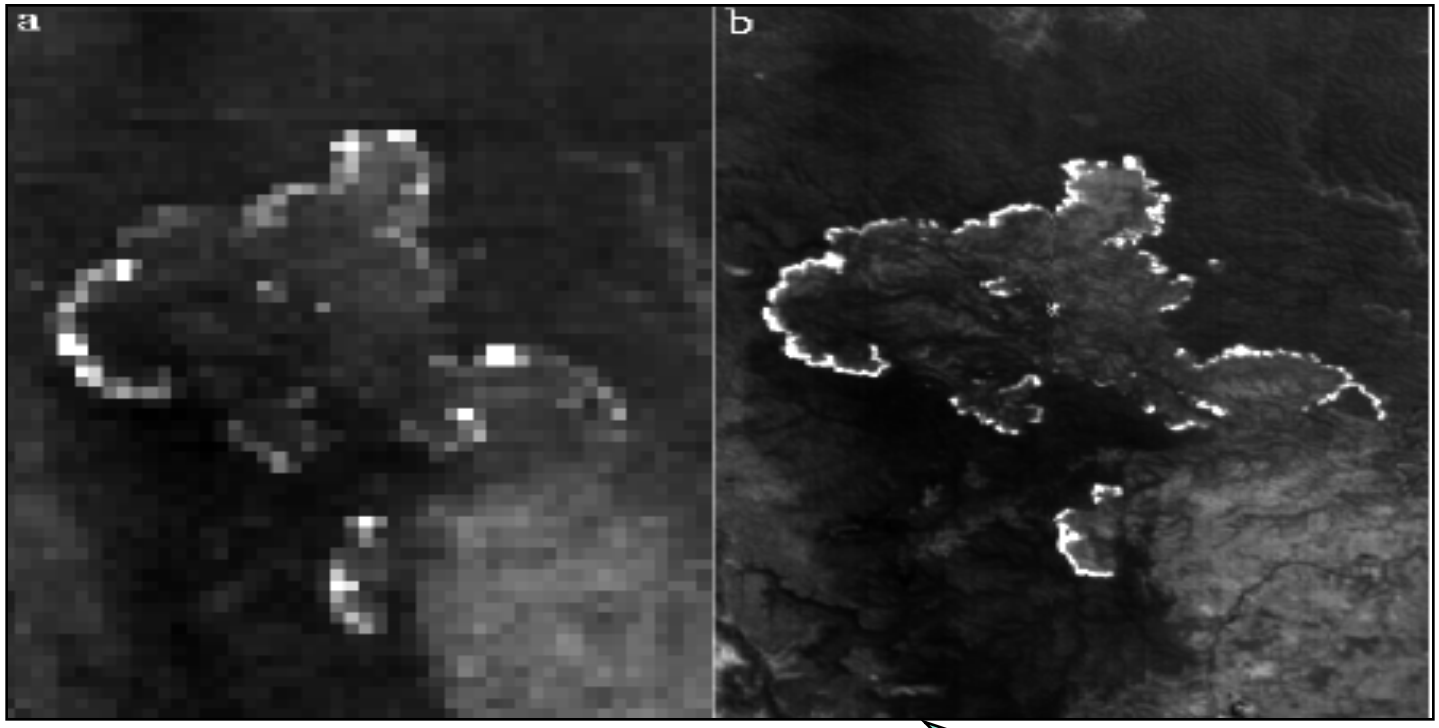
Fire Mapping and Fire Radiative Power



Example of MODIS resolution compared to BIRD resolution, which is similar to NIRST

MODIS data – 4µm band

BIRD data – 4µm band



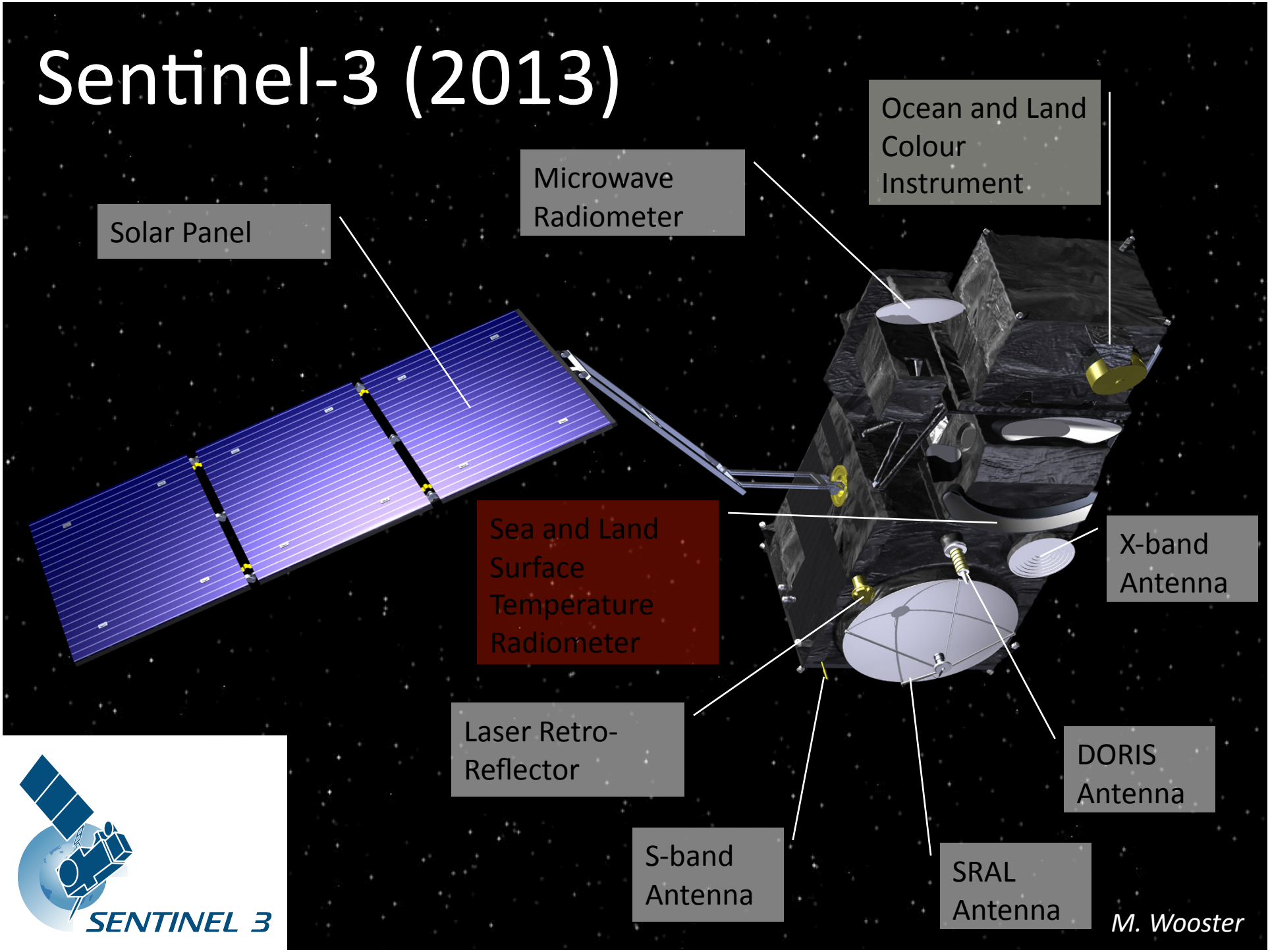
(From Wooster et al., 2003)

NIRST pixel size is similar to BIRD pixel size

ESA Sentinel-2 MSI

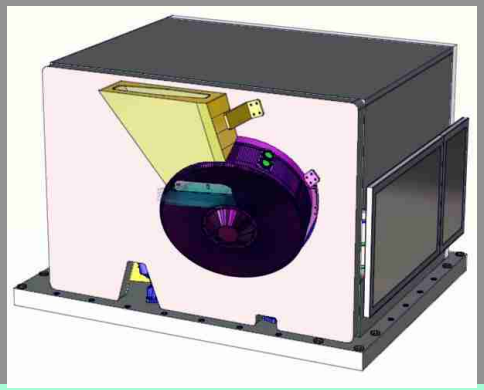
- Multi Spectral Instrument (MSI)
- Designed for continuity of Landsat and SPOT-type systems
- High resolution visible – SWIR bands
  - 10 m, 20 m, 60 m
- 290 km swath
- 2013 launch
- 5-day revisit time with two satellites operating concurrently
- Fuel mapping, burned area mapping, active fire detection using SWIR bands (?)

Sentinel-3 (2013)



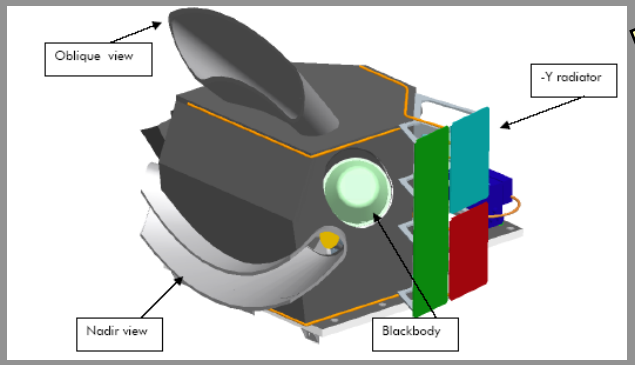
SENTINEL 3

Sentinel-3 Optical Instrument Resolution



Pushbroom type imager spectrometer
21 Spectral Channels
Full Resolution: Coastal/Land
Reduced Resolution: Open Ocean

OLCI – Open ocean	1.2 km
OLCI – Coastal ocean	300 m
OLCI - Land	300 m
SLSTR – Solar channels	500 m
SLSTR – Thermal channels	1 km

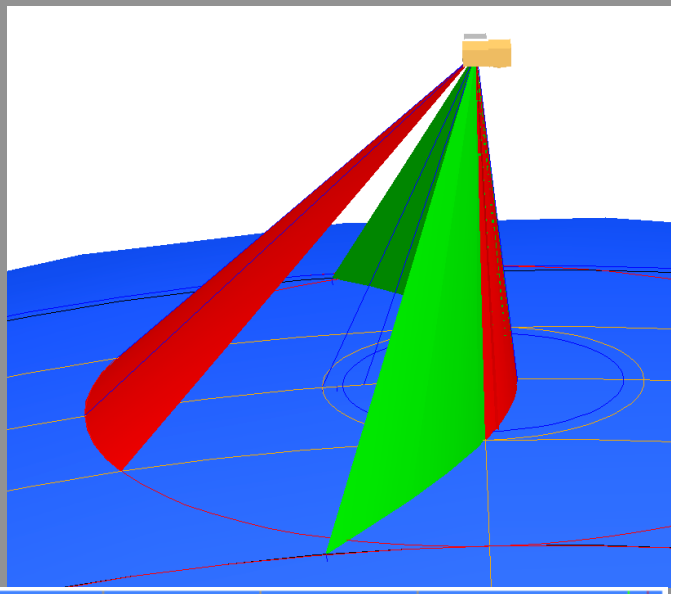


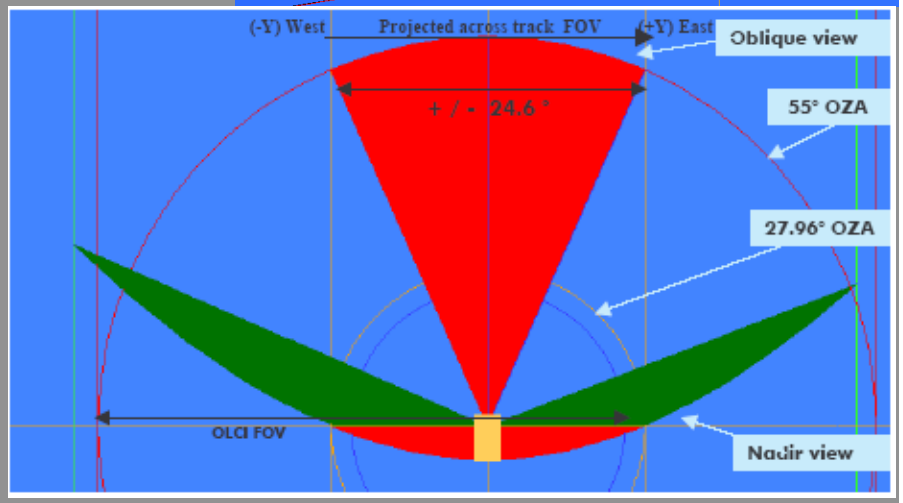
Conical imaging radiometer with a dual view capability:
• Near-nadir view
• Inclined view with an OZA of 55º
9 Spectral Channels + 2 (option) for Active FIRE

O. Arino, ESA

SLSTR Overview

- Heritage from AATSR, dual-view (nadir and backard) required for aerosol corrections:
  - Nadir swath >74° (1300 km min up to 1800 km)
  - Dual view swath 49° 750 km
  - Nadir swath covering OLCI
- 9 spectral bands:
  - Visible : 555 – 659 - 859 nm
  - SWIR : 1.38 – 1.61 – 2.25 μm
  - TIR : 3.74 – 10.85 – 12 μm
- One Vis/IR channel used for co-registration with OLCI





O. Arino, ESA

Sentinel-3 SLSTR Details

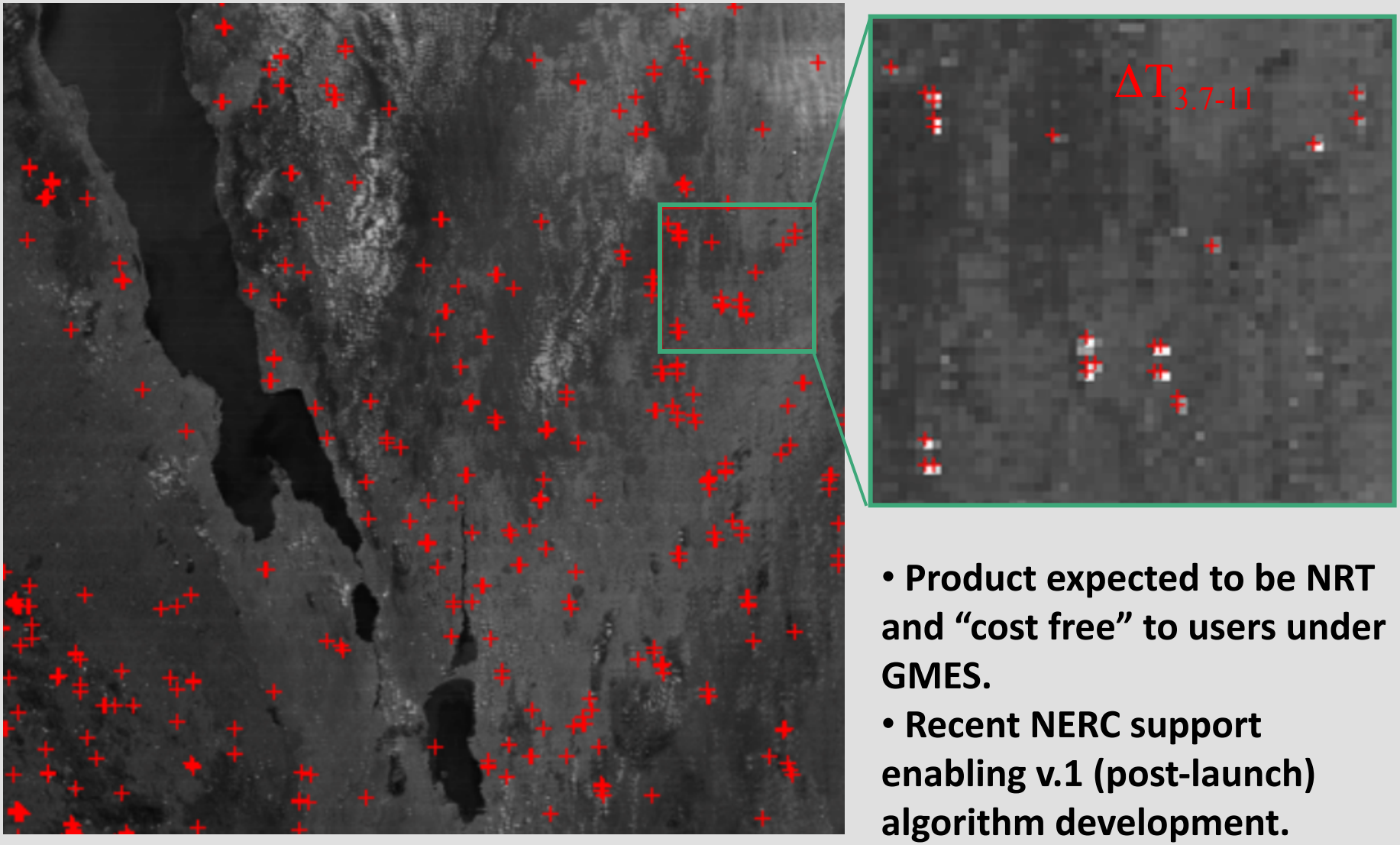
Band #	Centre λ_{centre} µm	Spectral Width $\Delta\lambda$ µm	Ref SSD
S1	0.555	0.02	0.5km
S2	0.659	0.02	0.5km
S3	0.865	0.02	0.5km
S4	1.375	0.15	0.5km
S5	1.61	0.06	0.5km
S6	2.25	0.05	0.5km
S7	3.74	0.38	1km
S8	10.85	0.9	1km
S9	12.0	1.0	1km
F1	3.74	0.38	1km
F2	10.85	0.9	1km

- SLSTR takes two views of Earth location within a few minutes (similar AATSR)
- Expanded Swaths@ ~ 1675 km (nadir view) + ~ 750 km (forward view)
- Extended dynamic range "fire channels "(F1 & F2)

- Two sun-synchronous Sentinel-3 satellites, local solar time ~ 10:00am
- Two satellites to obtain ~ 0.5 day revisit time.

M. Wooster

SLSTR Algorithm Prototyping & Testing (tested with MODIS MOD21data)



Multiple low FRP fires in Africa (Lake Malawi)

- **Product expected to be NRT and "cost free" to users under GMES.**
- **Recent NERC support enabling v.1 (post-launch) algorithm development.**

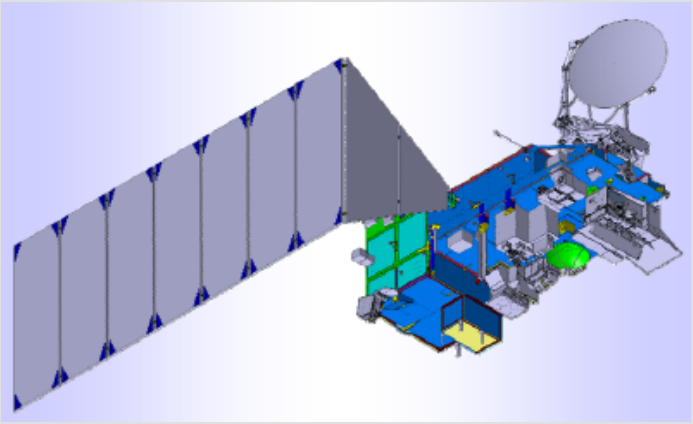
M. Wooster

NPP VIIRS and JPSS VIIRS

- JPSS (formerly NPOESS)
  - Joint Polar Satellite System
  - JPSS-1 launch 2016; 13:30 overpass
  - JPSS-2 launch 2019; 17:30 overpass
- NPP
  - NPOESS Preparatory Mission
  - Launch 27 Oct. 2011

JPSS Sensors

MIS	µwave Imager/Sounder
VIIRS	Visible/Infrared Imager
CrIS	Infrared Sounder
ATMS	Microwave Sounder
OMPS	Ozone
ADCS	Data Collection
SEM-N	Space Environment
SARSAT	Search & Rescue
CERES	Solar Irradiance



	1330	1730	NPP
VIIRS	X	X	X
MIS	X	X	
CrIS	X		X
ATMS	X		X
OMPS	X		X
ADCS	X	X	
SARSAT	X	X	
CERES	X		X
SEM-N	X	X	

Visible Infrared Imaging Radiometer Suite

VIIRS at a Glance

- VIIRS: Visible Infrared Imager Radiometer Suite
- VIIRS Heritage
  - OLS: Optical Line Scanner
  - AVHRR: Advanced Very High Resolution Radiometer
  - SeaWiFS: Sea viewing Wide Field-of-view Sensor
  - MODIS: Moderate Resolution Imaging Spectroradiometer
- VIIRS will provide operational and research users with:
  - Spectral coverage from 412 nm to 12 microns in 22 bands
    - Imagery at 375 m nadir resolution in 5 bands
    - Moderate resolution (750 m at nadir) radiometric quality data
  - Complete global daily coverage with a single sensor
- Near-real time data products
  - Cloud cover, cloud layers
  - Cloud and aerosol physical properties
  - Land & ocean biosphere properties, snow & ice
  - Sea Surface Temperature, Land & Ice Temperatures
  - **Fire detection**

B. Reed

Comparison of MODIS & VIIRS Bands

MODIS		VIIRS	
Band #	λ	λ	Band ID
1	620 - 670	600 - 680	I-1
2	841 - 876	845 - 885	I-2
3	459 - 479		
4	545 - 565		
5	1230 - 1250	1230 - 1250	M-8
6	1628 - 1652	1580 - 1670	M-10
		1580 - 1610	I-3
7	2105 - 2155	2225 – 2275	I-11
8	405 - 420	402-422	M-1
9	438 - 448	436-454	M-2
10	483 - 493	478-498	M-3
11	526 - 536		
12	546 - 556	545-565	M-4
13	662 - 672	662-682	M-5
14	673 - 683		
15	743 - 753	739-754	M-6
16	862 - 877	846-885	M-7
17	890 - 920		
18	931 - 941		
19	915 - 965		

MODIS		VIIRS	
Band #	λ	λ	Band ID
20	3.660 - 3.840	3.610 – 3.790	M-12
		3.550 – 3.930	I-4
21	3.929 - 3.989		
22	3.940 – 4.001		
23	4.020 - 4.080	3.973 – 4.128	M-13
24	4.433 – 4.498		
25	4.482 – 4.549		
26	1.360 - 1.390	1.371--1.386	M-9
27	6.535 - 6.895		
28	7.175 - 7.475		
29	8.400 - 8.700	8.400 – 8.700	M-14
30	9.580 - 9.880		
31	10.780 - 11.280	10.263 – 11.263	M-15
		10.050 - 12.400	I-5
32	11.770 - 12.270	11.538 – 12.488	M-16
33	13.185 - 13.485		
34	13.485 - 13.785		
35	13.785 - 14.085		
36	14.085 - 14.385		

MODIS bands 1-2 are 250 m at nadir
MODIS bands 3-7 are 500 m at nadir
MODIS bands 8-36 are 1000 m at nadir

VIIRS bands I1-I5 are 371 m at nadir
VIIRS bands M-1-M-16 are 742 m at nadir

B. Reed

VIIRS Sensor Bands

		Band No.	Wave-length (μm)	Horiz Sample Interval (km Downtrack x Crosstrack)		Driving EDRs	Radi-ance Range	Ltyp or Ttyp
				Nadir	End of Scan			
VIS/NIR FPA	Silicon PIN Diodes	M1	0.412	0.742 x 0.259	1.60 x 1.58	Ocean Color Aerosols	Low High	44.9 155
		M2	0.445	0.742 x 0.259	1.60 x 1.58	Ocean Color Aerosols	Low High	40 146
		M3	0.488	0.742 x 0.259	1.60 x 1.58	Ocean Color Aerosols	Low High	32 123
		M4	0.555	0.742 x 0.259	1.60 x 1.58	Ocean Color Aerosols	Low High	21 90
		I1	0.640	0.371 x 0.387	0.80 x 0.789	Imagery	Single	22
		M5	0.672	0.742 x 0.259	1.60 x 1.58	Ocean Color Aerosols	Low High	10 68
		M6	0.746	0.742 x 0.776	1.60 x 1.58	Atmospheric Corr'n	Single	9.6
		I2	0.865	0.371 x 0.387	0.80 x 0.789	NDVI	Single	25
		M7	0.865	0.742 x 0.259	1.60 x 1.58	Ocean Color Aerosols	Low High	6.4 33.4
CCD		DNB	0.7	0.742 x 0.742	0.742 x 0.742	Imagery	Var.	6.70E-05
S/MWIR	PV HgCdTe (HCT)	M8	1.24	0.742 x 0.776	1.60 x 1.58	Cloud Particle Size	Single	5.4
		M9	1.378	0.742 x 0.776	1.60 x 1.58	Cirrus/Cloud Cover	Single	6
		I3	1.61	0.371 x 0.387	0.80 x 0.789	Binary Snow Map	Single	7.3
		M10	1.61	0.742 x 0.776	1.60 x 1.58	Snow Fraction	Single	7.3
		M11	2.25	0.742 x 0.776	1.60 x 1.58	Clouds	Single	0.12
		I4	3.74	0.371 x 0.387	0.80 x 0.789	Imagery Clouds	Single	270 K
		M12	3.70	0.742 x 0.776	1.60 x 1.58	SST	Single	270 K
		M13	4.05	0.742 x 0.259	1.60 x 1.58	SST Fires	Low High	300 K 380 K
LWIR	PV HCT	M14	8.55	0.742 x 0.776	1.60 x 1.58	Cloud Top Properties	Single	270 K
		M15	10.763	0.742 x 0.776	1.60 x 1.58	SST	Single	300 K
		I5	11.450	0.371 x 0.387	0.80 x 0.789	Cloud Imagery	Single	210 K
		M16	12.013	0.742 x 0.776	1.60 x 1.58	SST	Single	300 K

VIIRS Fire Status: Algorithm

- Current algorithm/product in poor shape
  - Modified MODIS Collection 4 algorithm
  - No fire mask, no FRP
  - Product is simply a list of fire pixel locations
  - No higher level fire products
  - *Relatively simple to fix (software)*
    - NASA/NOAA to develop replacement algorithms

VIIRS Fire Status: Sensor

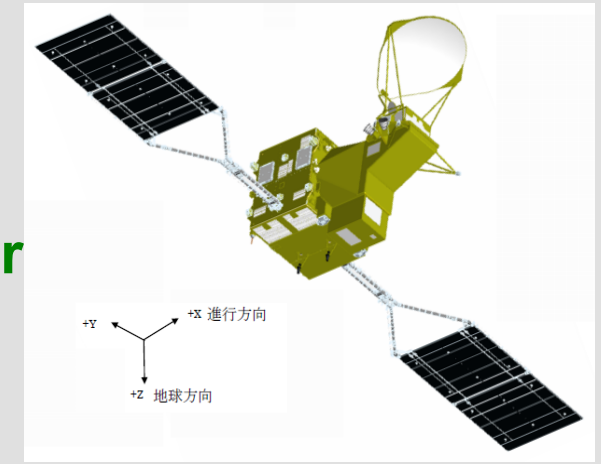
- In some respects superior to MODIS
  - Spatial coverage
  - Spatial resolution
  - Radiometric calibration
  - ~~Crosstalk~~
- LWIR band (M15) saturation too low
- Primary fire band (M13) susceptible to more atmospheric absorption than heritage instruments
- On-board aggregation flawed
  - Saturated pixels not properly handled
- Idiosyncratic features due to unusual lineage

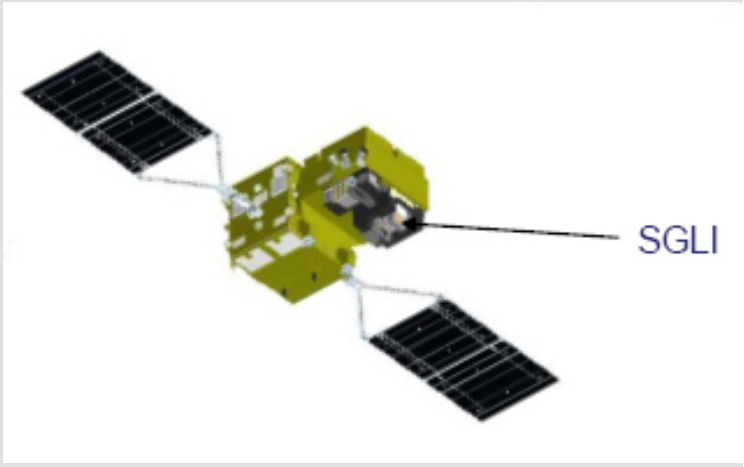
JAXA GCOM

- Global Change Observation Missions

GCOM satellites

- **GCOM-W1**
  - **AMSR2 (Advanced Microwave Scanning Radiometer 2)**
  - **Planned to be launched in Winter 2012**
- **GCOM-C1**
  - **SGLI (Second generation Global Imager)**
  - **Planned to be launched in 2013**
- **Plan for the 2nd and 3rd generations**
  - **GCOM-W2 (in 2016), GCOM-W3 (in 2020)**
  - **GCOM-C2 (in 2017), GCOM-C3 (in 2021)**





H. Shimoda

CGOM-C1

- Orbit
  - Sun synchronous orbit
  - Height: about 800km
  - Local time of descending node: 10:30
- Weight: about 2.0t
- Power Consumption: about 4.3kW
- Lifetime: 5 years
- Data transmission
  - Global observation data are stored and transmitted every orbit period
  - Observed data over Japanese islands are transmitted to JAXA ground station in real time

SGLI

- Wide spectrum coverage
- VIS, NIR, SWIR, TIR
- Polarization measurements
- Multiple angle observation
- Multiple telescopes

H. Shimoda

VNIR					H. Shimoda	
Ch.	central wavelength [nm]	IFOV [m]	⊿λ [nm]	Lλ [W/m²/str/μm]	L_{max} [W/m²/str/μm]	S/N
VN1	380	250	10	60	210	250
VN2	412	250	10	75	250	400
VN3	443	250	10	64	400	300
VN4	490	250	10	53	120	400
VN5	530	250	20	41	350	250
VN6	565	250	20	33	90	400
VN7	670	250	10	23	62	400
VN8	670	250	20	25	210	250
VN9	763	1000	8	40	350	400
VN10	865	250	20	8	30	400
VN11	865	250	20	30	270	200

Polarization channels (3 directions)

Ch.	central wavelength [nm]	IFOV [m]	$\Delta\lambda$ [nm]	$L\lambda$ [$W/m^2/str/\mu m$]	$L_{max.}$ [$W/m^2/str/\mu m$]	S/N
P1-1	670	1000	20	25	250	250
P1-2	670	1000	20	25	250	250
P1-3	670	1000	20	25	250	250
P2-1	865	1000	20	30	300	250
P2-2	865	1000	20	30	300	250
P2-3	865	1000	20	30	300	250

H. Shimoda

IRS						
Ch.	central wavelength [μm]	IFOV[m]	$\Delta\lambda$[μm]	L_λ[W/m^2/str/μm] or Tstd[K]	L_{max}[W/m^2/str/μm] or T_{max}[K]	S/Nor NEdT@300[K]
SW1	1.05	1000	0.02	57	248	500
SW2	1.38	1000	0.02	8	103	150
SW3	1.63	250	0.2	3	50	57
SW4	2.21	1000	0.05	1.9	20	211
T1	10.8	500	0.7	300	340	0.2
T2	12.0	500	0.7	300	340	0.2

H. Shimoda

Standard products (land)

products	GSD	accuracy
radiance	250/1000m	5%, 0.5K
geom. corr. rad.	250m	0.5pixel
land surface refl.	250m	5%/10%*1
veg. index	250m	20%/15%*2
veg. roughness. index	1km	20%/15%*2
shadow index	1km	20%/15%*2
land surf. temp	500m	2.5K
fAPAR	250m	30%/20%*2
LAI	250m	30%
above ground biomass	1km	30%

*1 : >443nm / ≤443nm *2 : grass land / forest

H. Shimoda

Research products (land)

products	GSD	accuracy
net primary prod.	1km	TBD
veg. water stress index	500m	TBD
fire	500m	TBD
land cover class.	250m	TBD
land surface albedo	1km	TBD

H. Shimoda

USGS/NASA Landsat Data Continuity Mission (LDCM)

- "Landsat 8"
- Two sensors
  - Operational Land Imager (OLI)
    - SNR much higher than that of Landsat 7
  - Thermal Infrared Sensor (TIRS)
- December 2012 launch
  - Atlas V LDCM-specific launch

LDCM Spectral Bands

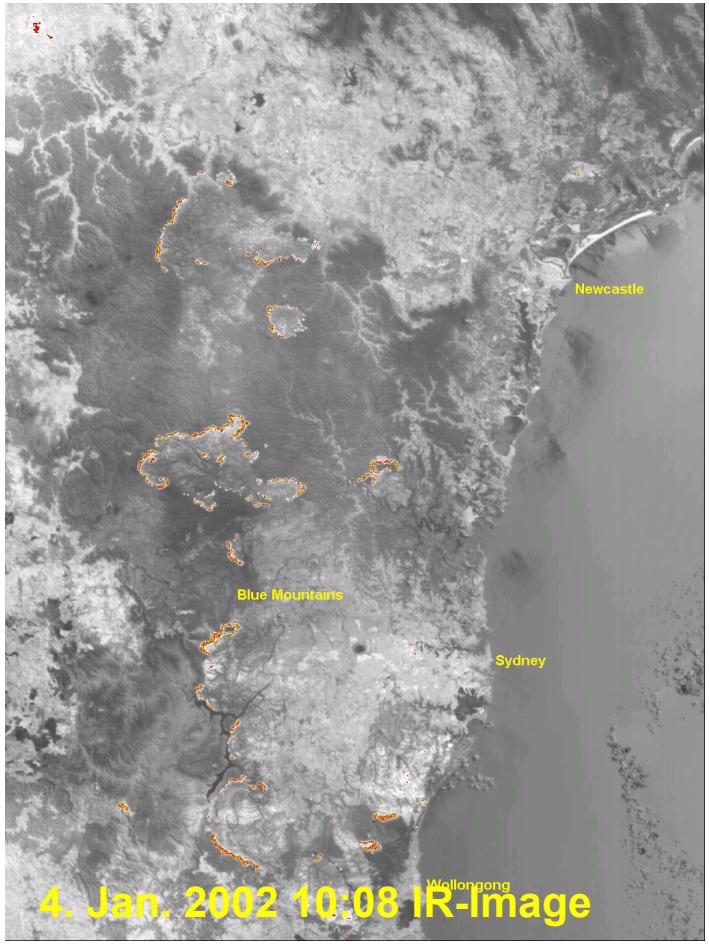
L7 ETM+ Bands		LDCM OLI/TIRS Band Requirements	
		30 m, Coastal/Aerosol, 0.433–0.453 µm **(*A)**	Band 1
Band 1	30 m, Blue, 0.450 - 0.515 µm	30 m, Blue, 0.450–0.515 µm	Band 2
Band 2	30 m, Green, 0.525 - 0.605 µm	30 m, Green, 0.525–0.600 µm	Band 3
Band 3	30 m, Red, 0.630 - 0.690 µm	30 m, Red, 0.630–0.680 µm	Band 4
Band 4	30 m, Near-IR, 0.775 - 0.900 µm	30 m, Near-IR, 0.845–0.885 µm	Band 5
Band 5	30 m, SWIR-1, 1.550 - 1.750 µm	30 m, SWIR-1, 1.560–1.660 µm	Band 6
Band 7	30 m, SWIR-2, 2.090 - 2.350 µm	30 m, SWIR-2, 2.100–2.300 µm	Band 7
Band 8	15 m, Pan, 0.520 - 0.900 µm	15 m, Pan, 0.500–0.680 µm	Band 8
		30 m, Cirrus, 1.360–1.390 µm **(*B)**	Band 9
Band 6	60m, LWIR, 10.00–12.50 µm	100 m, LWIR-1, 10.30–11.30 µm **(*C)**	Band 10
		100 m, LWIR-2, 11.50–12.50 µm **(*C)**	Band 11

Source: NASA/USGS NP-2009-11-109-GSFC

DLR TET-1

Historical Background and Heritage

Proven technology based on DLR-BIRD mission



German BIRD mission (2001-04)

Demonstrator for

- State of the art Infra-red sensor technology
- High geometric (300m) and
- Radiometric resolution (0.5 – 10 MWatt)
- Small and low cost satellite technology
- Operational during 2001 – 2004
- Fire images from all global locations

TET-1 mission will be followed in 2010 and equipped with improved IR camera based on BIRD heritage

Historical Background and Heritage

Proven technology based on DLR-BIRD mission

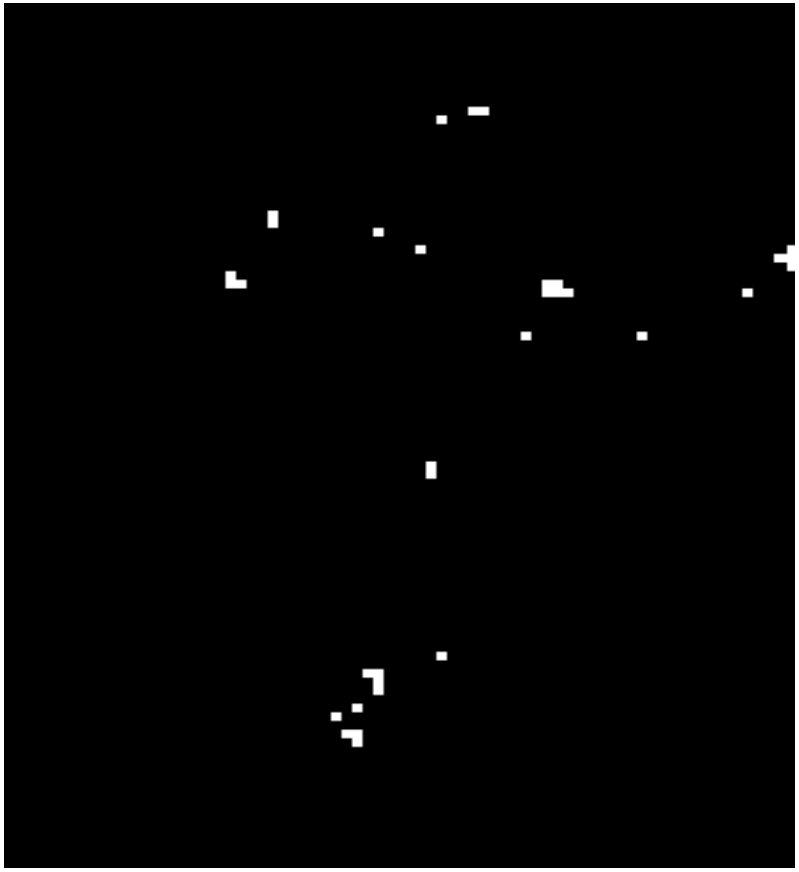
BIRD main sensor payload

	WAOSS-B	HSRS
Spectral bands of nadir-looking channels[1]	NIR: 0.84-0.90 µm	MIR: 3.4-4.2 µm TIR: 8.5-9.3 µm
Pixel number	2880	2x512 staggered
Ground pixel size	185 m	370 m
Sampling step	185 m	185 m
Swath width	533 km	190 km
Number of exposures	1	2
Quantisation	11 bit	14 bit for each exposure

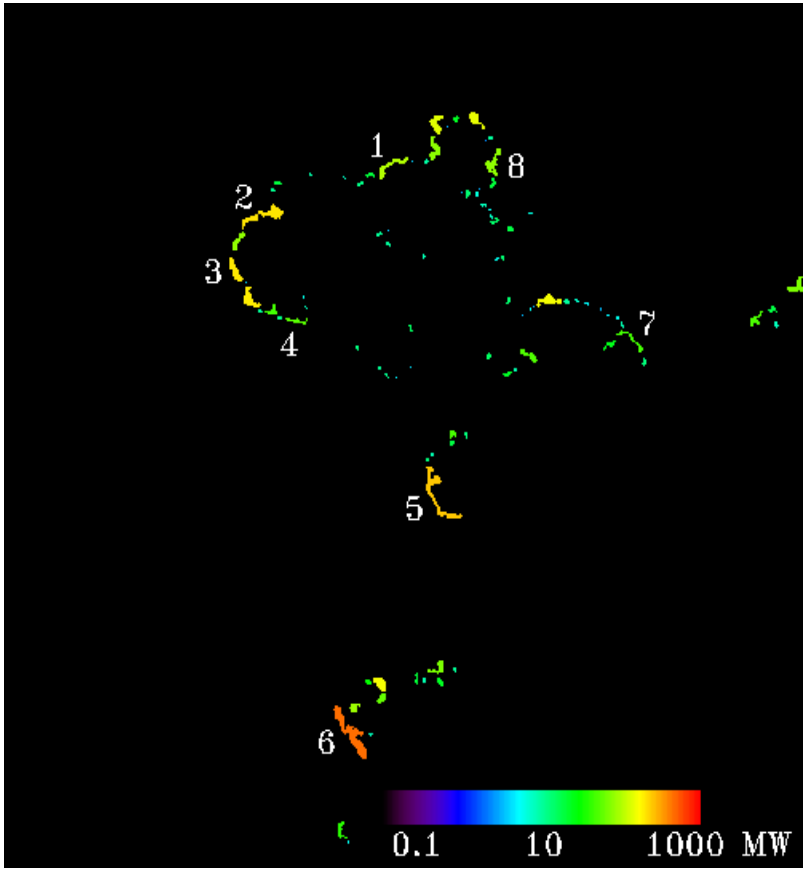
- **Payload platform with assembling tools (total mass: 30.2 kg)**

[1]WAOSS has also 2 stereo channels (VIS and NIR)

Comparison with other systems dedicated to fire detection



MODIS standard fire product



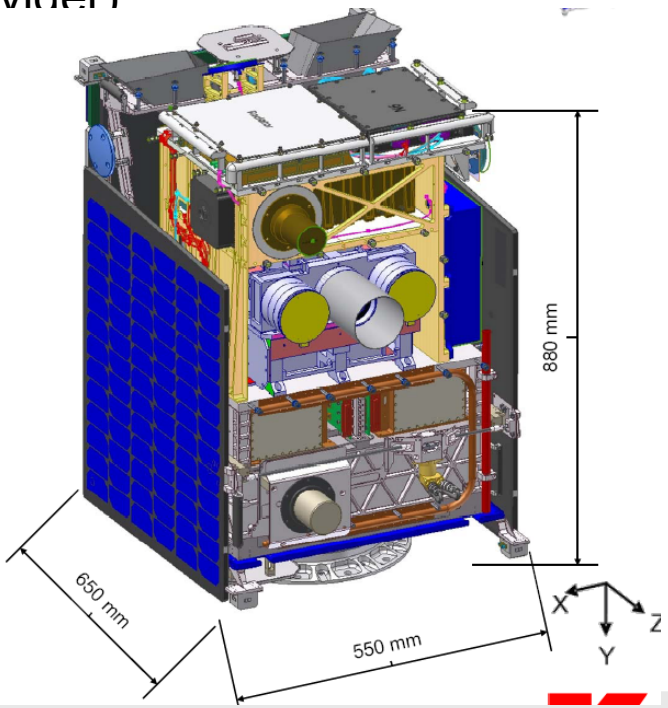
BIRD fire map

The current BIRD follow Program in Germany

The TET-1 Satellite

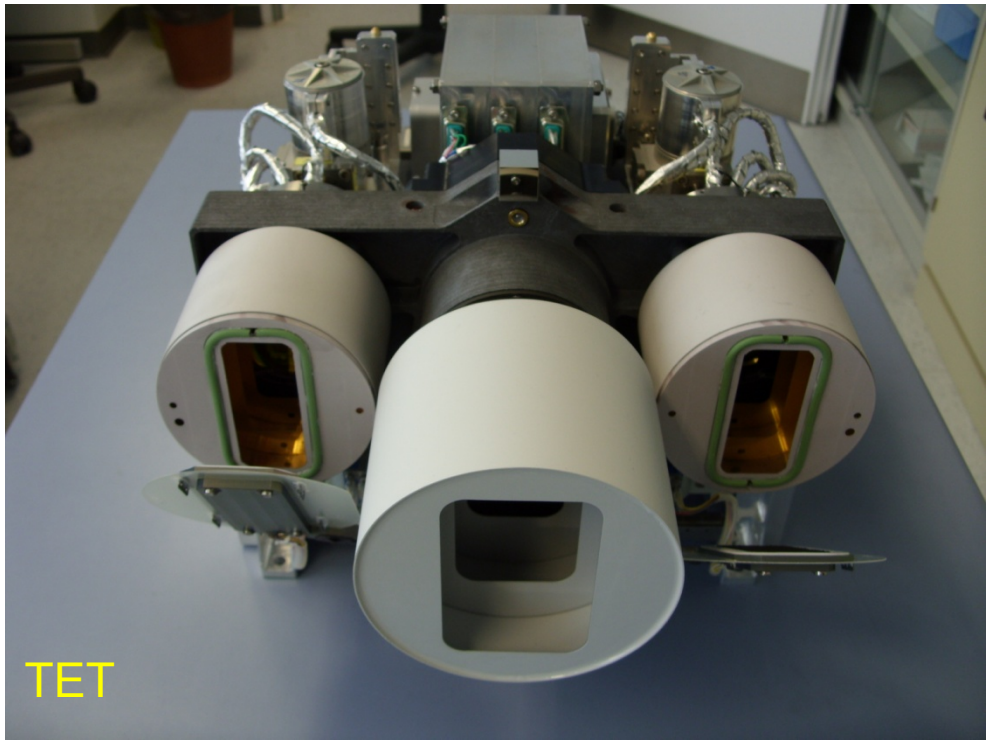
- Based on the BIRD Satellite Technology the German Space Agency initiated in 2005 the OOV Program
- The first programme part will be finalised in 2011 with the launch of the TET-1 Satellite (postponed to early 2012 by the launch provider)

- The TET Satellite is primary dedicated to technological experiments and not to fire monitoring
- A BIRD like IR Instrument was added later
- In the first year the observation time has to be shared with other, but smaller instruments



The current BIRD follow Program in Germany

The TET-1 Satellite

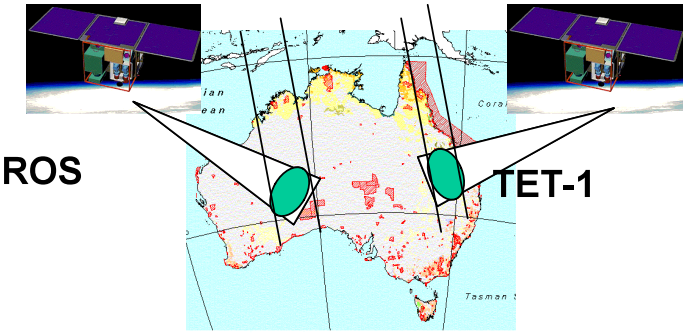


- The basic Parameters for the IR instrument on TET are mainly the same as for the BIRD instrument
- Compared to BIRD a powerful on board processing will be implemented dedicated to the generation of high level fire observation data products

The current BIRD follow Program in Germany

The BIROS Proposal

In September 2010 the Federal Ministry of Education and Research grtanted the BIROS Proposal for a second satellite capable to fly a two-satellite-constellation with TET-1. This will be a satellite dedicated to the fire observation.



Letter of Intent for Utilisation of TET-1 and BIROS Missions

SLST, MODIS and the geostationary systems are excellent tools for providing real-time observations of active fires, and for quantifying the fires radiative power (FRP) output, which we use as a metric for the rate of emission of smoke. Their limitation is two-fold however, firstly there is very little information on which to base validation of the FRP estimates, and secondly even under optimum conditions only the FRP of fires burning down to ~ 10 MW cannot be assessed by such systems as their data are too spatially coarse to detect such fires. This leaves a very important “observation gap” since such “low intensity” fires are actually the most common type, and may well be responsible for a significant fraction of overall fire emissions in many areas.

KING'S College LONDON
University of London

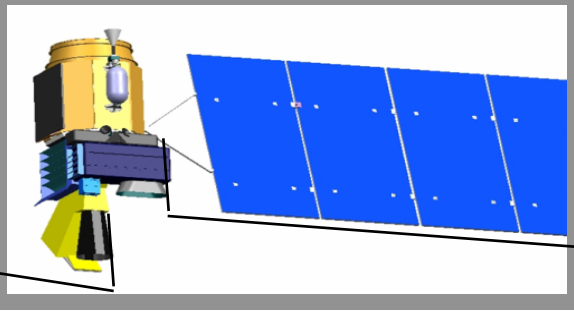
NRC Decadal Survey HyspIRI

Visible ShortWave InfraRed (VSWIR) Imaging Spectrometer

+

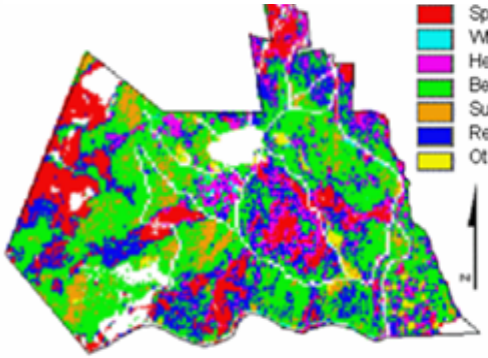
Multispectral Thermal InfraRed (TIR) Scanner

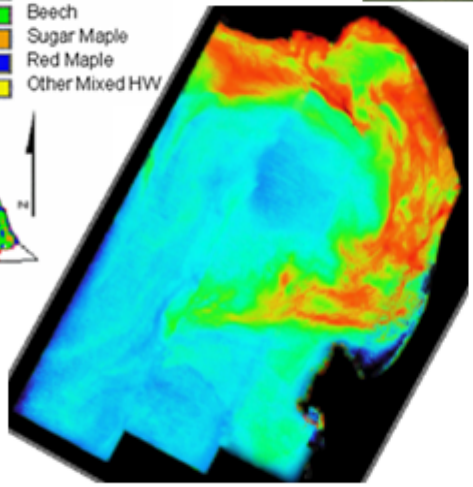
VSWIR: Plant Physiology and Function Types (PPFT)



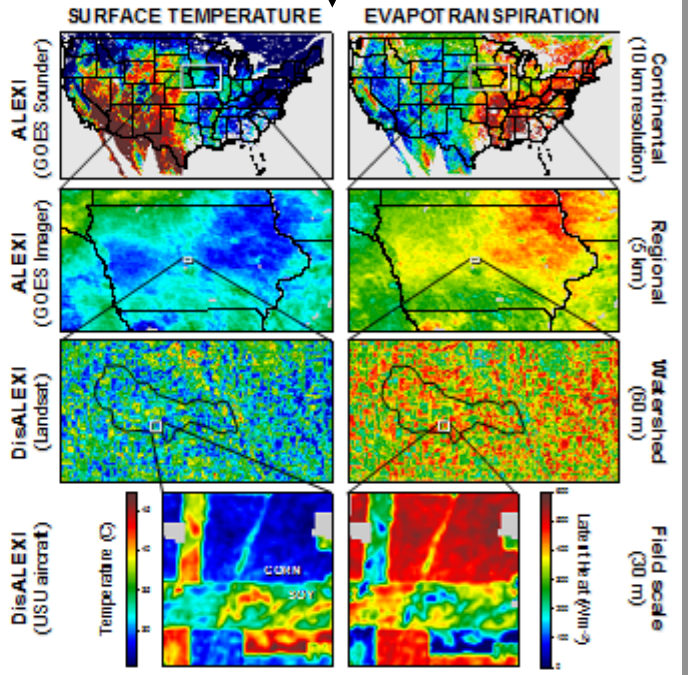
Multispectral TIR Scanner

Map of dominant tree species, Bartlett Forest, NH





Red tide algal bloom in Monterey Bay, CA

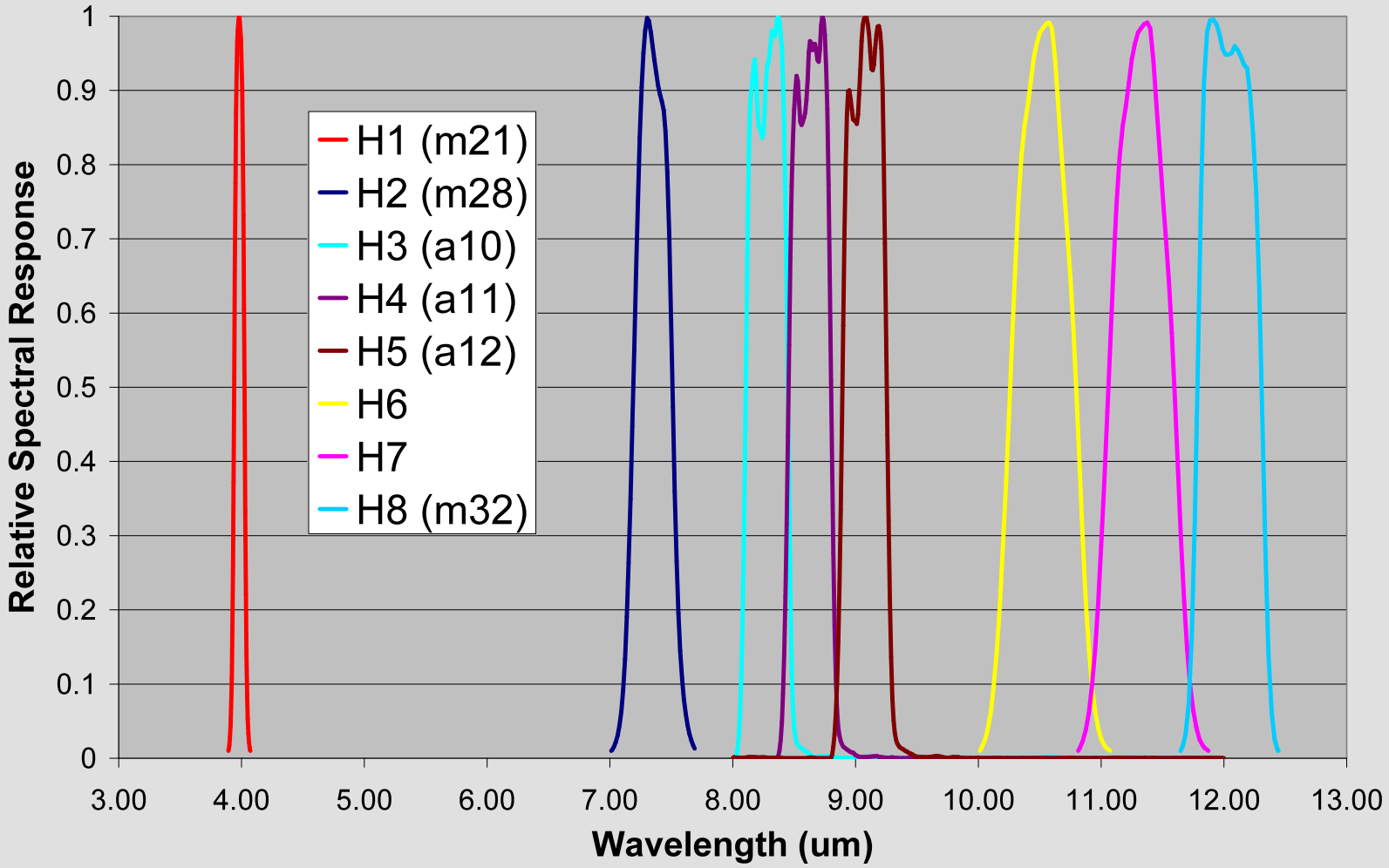


R. Green and S. Hook, NASA JPL

HysplRI (2019)

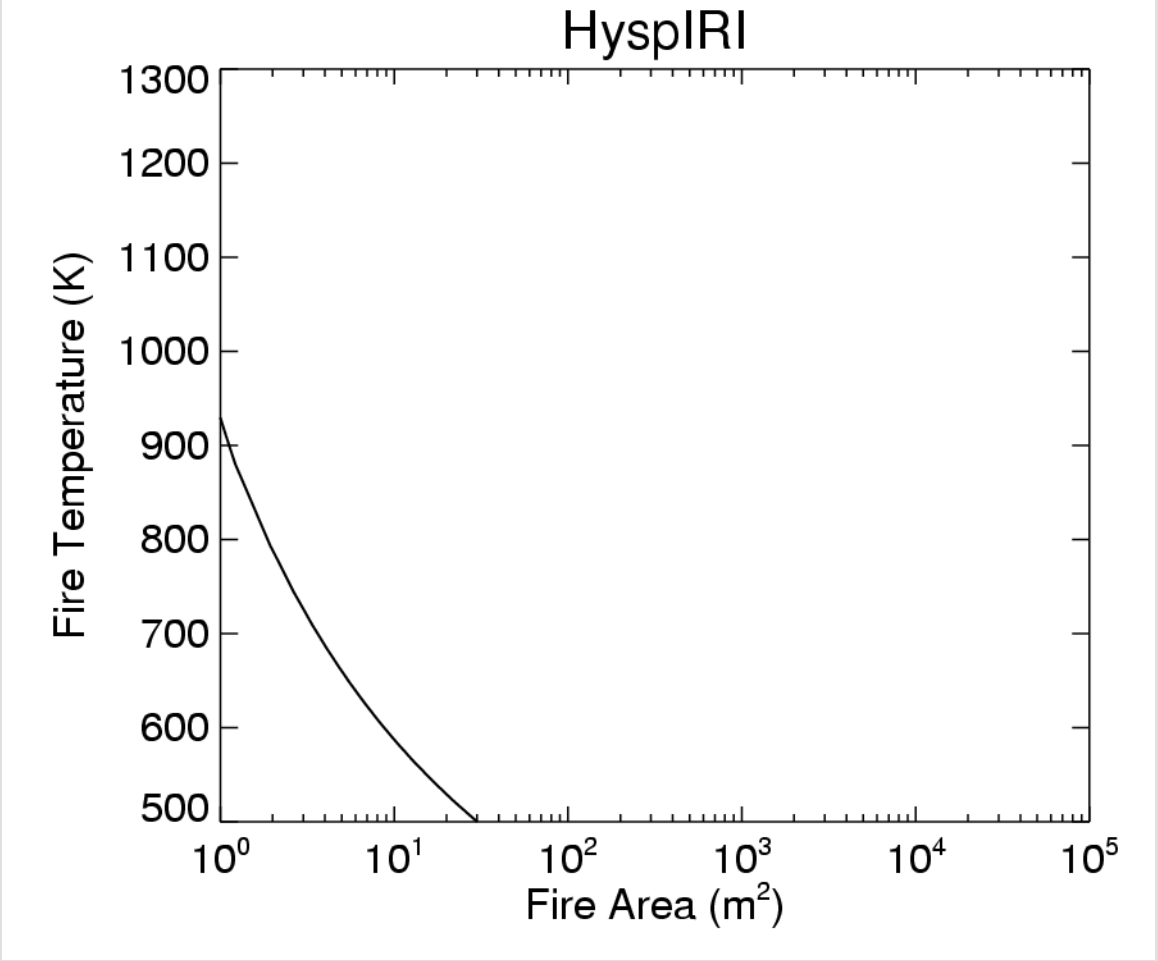
- Hyperspectral sensor
  - 380 nm – 2500 nm
  - 60 m spatial resolution
  - 90 km swath, 19-day revisit time
- Thermal sensor
  - 8 bands
    - mid-IR fire band (1200 K saturation!)
  - 60 m spatial resolution
  - 400 km swath, 5-day revisit time
- Acquisition over global land and shallow water
- Direct broadcast capability

HyspIRI Thermal Bands



R. Green and S. Hook, NASA JPL

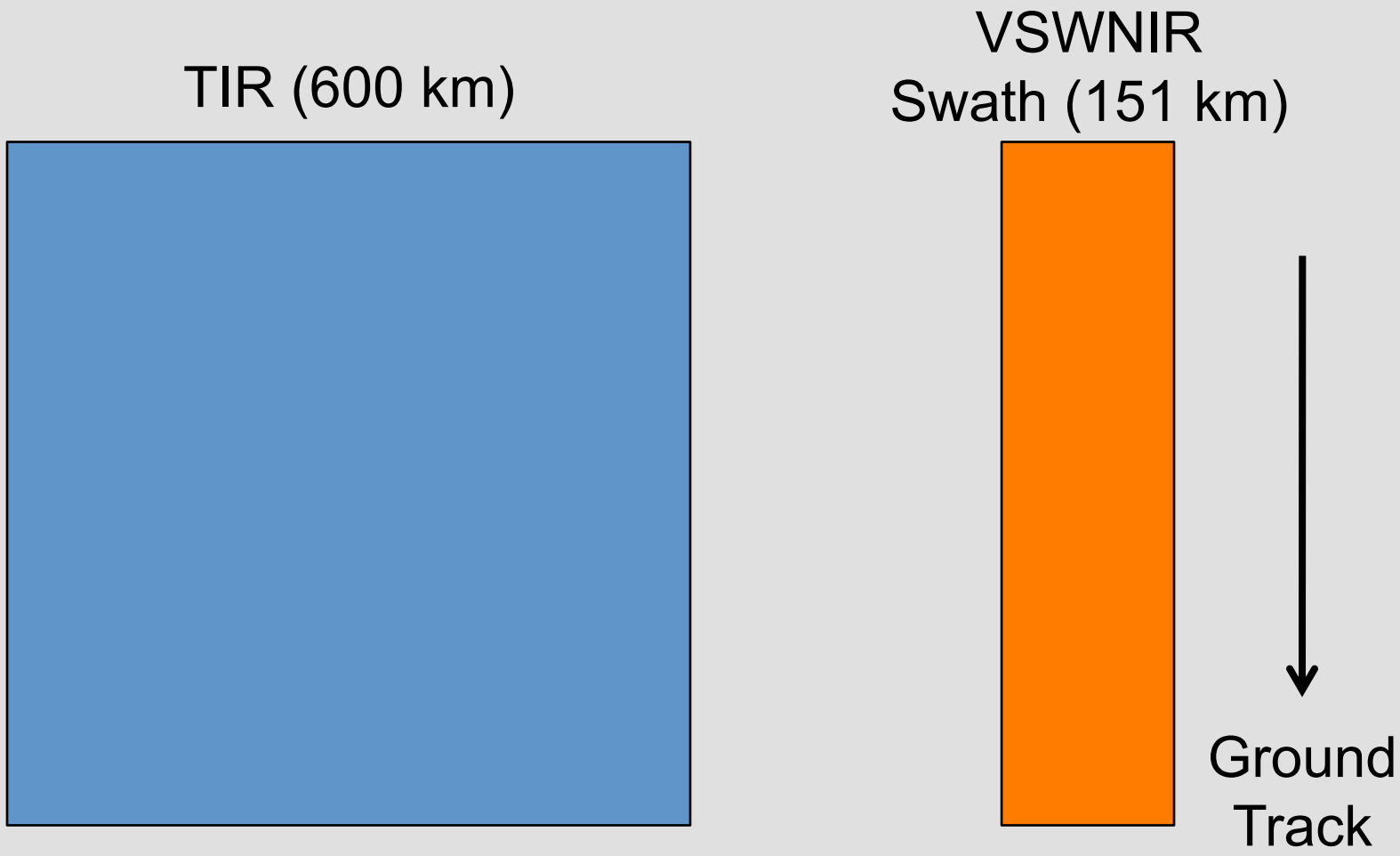
HyspIRI Detection Envelope



60 m

90% probability of detection; boreal forest; nadir view

HyspIRI Ground Coverage

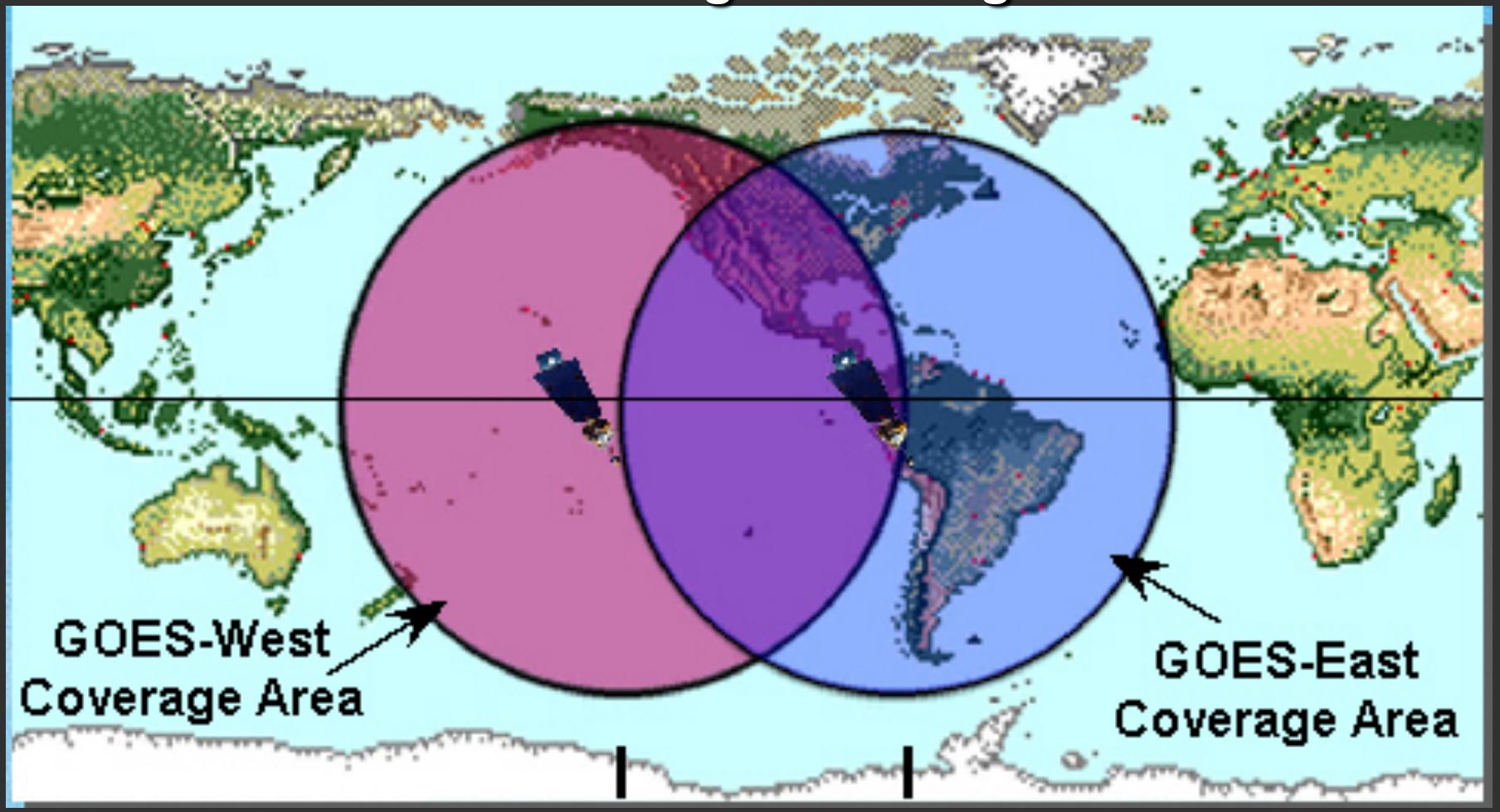


GOES-ABI (Advanced Baseline Imager) 2014 Launch

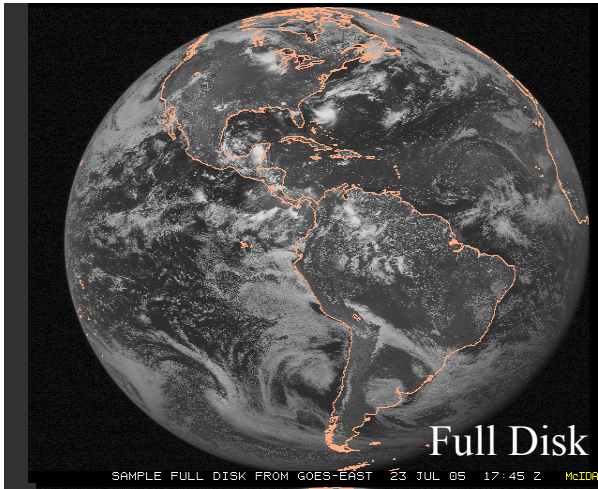
GOES-R slides courtesy of Ivan Csiszar (NOAA-NESDIS)

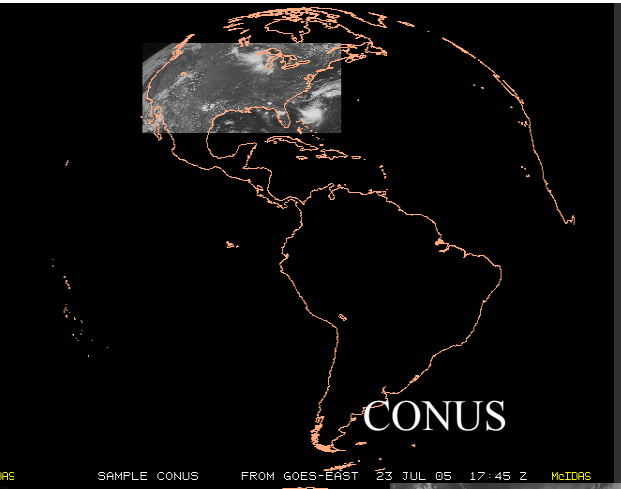
GOES-R Mission

US GOES Imager Coverage

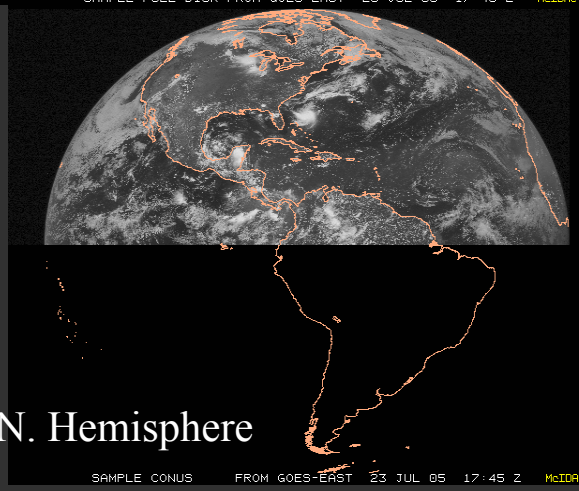


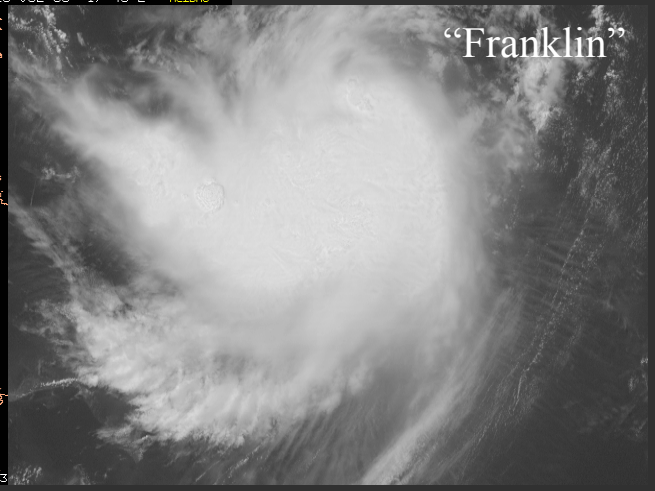
ABI Sensor
-- Scan Mode





*ABI scans about **5 times faster** than the current GOES imager*





There are two anticipated scan modes for the ABI:

- Full disk images every 15 minutes + 5 min CONUS images + mesoscale
- Or, full disk every 5 minutes

ABI Sensor Channels

GOES ABI Band	Central Wavelength (μm)	sub-satellite IGFOV (km)	Land Product Use
1	0.47	1	Albedo
2	0.64	0.5	Fire, albedo, NDVI/GVF Flood
3	0.865	1	Albedo, NDVI/GVF, Flood
4	1.378	2	Albedo?
5	1.61	1	Albedo
6	2.25	2	Fire, Albedo
7	3.90	2	Fire
8	6.19	2	
9	6.95	2	
10	7.34	2	
11	8.5	2	
12	9.61	2	
13	10.35	2	Fire
14	11.2	2	LST, Fire, Flood
15	12.3	2	LST Fire, Flood
16	13.3	2	

SEVIRI as ABI Proxy

GOES-R ABI

Channel	Nominal Central Wavelength, µm
1	0.47
2	0.64
3	0.86
4	1.38
5	1.61
6	2.26
7	3.9
8	6.19
9	6.95
10	7.34
11	8.5
12	9.61
13	10.35
14	11.2
15	12.3
16	13.3

Observations every 15 min

Spatial resolution:
- 0.5 km visible
- 2 km all other

Position: 75W and 135W

Launch: 2014

MSG SEVIRI

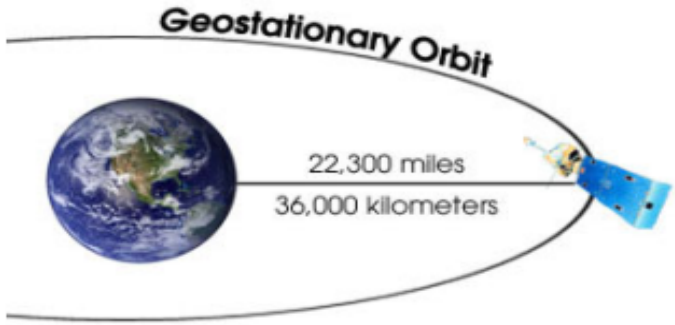
Channel	Nominal Central Wavelength, µm
1	0.64
2	0.81
3	1.64
4	3.92
5	8.70
6	10.8
7	12.0
8	6.25
9	7.35
10	9.66
11	13.40
12	HRV

Observations every 15 min

Spatial resolution:
- 1 km HRV (visible)
- 4 km all other

Position: 0E

Launched: 2004



GOES: Geostationary Operational Environmental Satellite

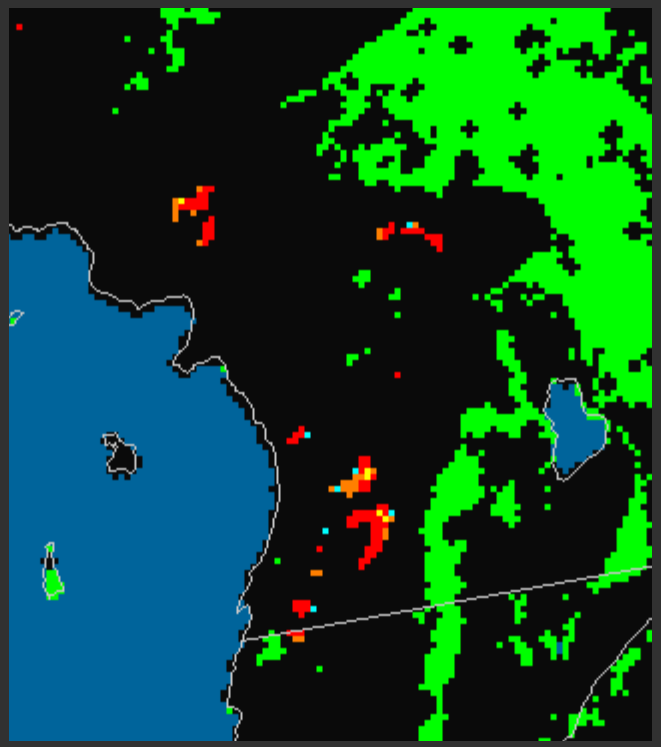
ABI: Advanced Baseline Imager

MSG: Meteosat Second Generation

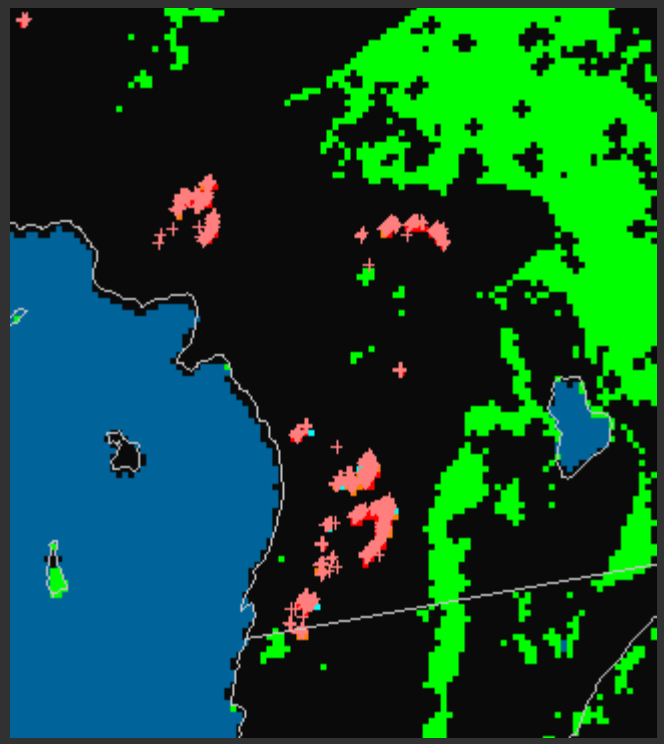
SEVIRI: Spinning Enhanced Visible and Infrared Imager

ABI Fire Product Comparisons with MODIS

Comparison of ABI WF_ABBA Fire Product with MODIS Fire Product in So. California
Date: October 27, 2003 Time: 20:55 UTC



ABI WFABBA Fire Mask



ABI WFABBA Fire Mask with MODIS overlay

Geo-Africa

- African Space Observatory Mission
- Geostationary satellite, 15 deg. E longitude
- Full African coverage every 4 days
- 90 300 km × 300 km scenes acquired per day
  - Pointable
- 25 m – 35 m resolution, 11 bands
- Possible 4 and 11 micron bands (?)
- 2014 operational time frame (?)

Potential Discussion Issues

- UNIFORM, MIROS
- Everything I missed
- Data availability
  - Free?
- Direct broadcast capability